

WHAT WE CLAIM IS:

1. A two-dimensional optical scanner, comprising
in combination:

a light source,

5 a scanner unit for scanning a light beam from said
light source on the surface to be scanned in a two-
dimensional direction, and

a scanning optical system having a non-rotationally
symmetric surface, wherein:

10 said scanner unit has a gimbal structure, and
said scanning optical system comprises a decentered
prism having an entrance surface through which a light
beam scanned by said scanner unit enters said prism, at
least one reflecting surface for allowing a light beam
15 entered from said entrance surface into said prism to be
reflected in said prism and an exit surface through which
a light beam reflected at said second reflecting surface
leaves said prism, wherein at least one of said entrance
surface, said reflecting surface and said exit surface
20 comprises a non-rotationally symmetric surface.

2. The two-dimensional optical scanner according
to claim 1, wherein:

said decentered prism has a first reflecting surface
for allowing a light beam entered from said entrance
25 surface into said prism to be reflected in said prism and
a second reflecting surface for allowing a light beam
reflected at said first reflecting surface to be reflected
in said prism.

3. The two-dimensional optical scanner according to claim 1, wherein:

the respective surfaces of said decentered prism are located such that a light beam from said entrance surface toward said first reflecting surface crosses a light beam from said second reflecting surface toward said exit surface in said prism.

4. The two-dimensional optical scanner according to claim 1, wherein:

at least one surface of said decentered prism also serves as an optical surface through which light from said light source enters said scanner unit.

5. The two-dimensional optical scanner according to claim 4, wherein:

at least one surface of said decentered prism also serves as an optical surface for reflecting light from said light source toward said scanner unit.

6. The two-dimensional optical scanner according to claim 1, wherein:

said scanner unit comprises a scanning mirror, an axial chief ray of said light beam is reflected at at least two reflecting surfaces while said axial chief ray propagates from said surface to be scanned to said scanning mirror, and

the following two conditions (1) and (2) are satisfied:

$$10^{\circ} < \Theta_1 < 40^{\circ} \quad \dots (1)$$

$$10^{\circ} < \Theta_2 < 40^{\circ} \quad \dots (2)$$

where Θ_1 and Θ_2 are angles that said axial chief ray subtends a normal to said at least two reflecting surfaces at positions where said axial chief ray is incident on said at least two reflecting surfaces; Θ_1 is an angle that said axial chief ray subtends said normal to one of said at least two reflecting surface and Θ_2 is an angle that said axial chief ray subtends said normal to the other of said at least two reflecting surfaces, provided that an axial ray is defined by a light ray that comes out of the surface to be scanned to a center of the scanning mirror.

7. The two-dimensional optical scanner according to claim 1, wherein:

15 said scanner unit comprises a scanning mirror, and the following condition (3) is satisfied,

$$1^{\circ} < \Theta_m < 45^{\circ} \quad \dots (3)$$

where Θ_m is an angle that a given light ray subtends a normal to a surface at a position where said given light ray is incident on said surface, provided that said given light ray is defined by a light ray that propagates toward a center position of said surface to be scanned.

8. The two-dimensional optical scanner according to claim 1, wherein:

25 said light source is a light-emitting diode or a laser diode.

9. The two-dimensional optical scanner according

to claim 1, wherein:

said light source includes at least R, G and B wavelengths.

10. The two-dimensional optical scanner according
5 to claim 9, which further comprises an optical synthesis
element for synthesizing light rays of at least R, G and B
wavelengths.

11. The two-dimensional optical scanner according
to claim 9, wherein:

10 said light source comprises at least emitting
portions for emitting said light rays of R, G and B
wavelengths, wherein said emitting portions are located
such that said light rays of R, G and B wavelengths are
mutually shifted.

15 12. The two-dimensional optical scanner according
to claim 11, wherein:

said emitting portions are located in such a way as
to have the same scan start positions.

20 13. The two-dimensional optical scanner according
to claim 11, wherein:

said emitting portions are located in such a way as
to have different scan start positions, and

modulation is performed at different timings with
respect to light rays emitted out of said respective
25 emitting portions.

14. A two-dimensional optical scanner, comprising
in combination:

a light source,

a scanner unit for scanning a light beam from said light source on a surface to be scanned in a two-dimensional direction, and

a scanning optical system having a non-rotationally
5 symmetric surface, wherein:

said scanning optical system comprises a decentered prism having at least one reflecting surface and configured into a shape in which a symmetric surface exists,

10 said scanning optical system is located such that said symmetric surface does substantially include the origin of a screen surface defined by a point of intersection of an optical axis of said scanning optical system with the surface to be scanned, and

15 said scanning optical system and said scanner unit are located such that one scanning direction is substantially in line with a direction of said symmetric surface.

15. An image display system, comprising in
20 combination:

a light source,

a scanner unit for scanning a light beam from said light source on a surface to be scanned in a two-dimensional direction,

25 a scanning optical system having a non-rotationally symmetric surface, and

an eyepiece optical system located near said surface to be scanned and having positive power, wherein:

said scanner unit has a gimbal structure, and
said scanning optical system comprises a decentered
prism having an entrance surface through which a light
beam scanned by said scanner unit enters said prism, at
5 least one reflecting surface allowing a light beam entered
from said entrance surface into said prism to be reflected
in said prism and an exit surface through which a light
beam reflected at said second reflecting surface leaves
said prism, wherein at least one of said entrance surface,
10 said reflecting surface and said exit surface comprises a
non-rotationally symmetric surface.

16. The image display system according to claim 15,
which further comprises a diffusing surface located near
said surface to be scanned and having optical
15 diffusibility.

17. The image display system according to claim 15,
wherein said diffusing surface has a property such that an
angle of diffusion is 20° or smaller at full width where
light intensity goes down to 1/10.

20 18. The image display system according to claim 16,
wherein at least two such diffusing surfaces are provided.

19. The image display system according to claim 15,
wherein said eyepiece optical system comprises a Fresnel
lens.

25 20. The image display system according to claim 15,
wherein said eyepiece optical system comprises a Fresnel
reflecting mirror.

21. The image display system according to claim 15,
wherein said eyepiece optical system comprises a Fresnel
back-surface reflecting mirror.

22. The image display system according to claim 16,
5 wherein said diffusing surface is provided on at least one
surface of said eyepiece optical system.

23. The image display system according to claim 15,
wherein said decentered prism further comprises a first
reflecting surface for allowing a light beam entered from
10 said entrance surface into said prism to be reflected in
said prism and a second reflecting surface for allowing a
light beam reflected at said first reflecting surface to
be reflected in said prism.